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Two New Cave Millipedes from Southwest Japan*

With 2 Text-figures

Yoshiteru MURAKAMI

Oshima Junior High School, Niihama, Ehime 792, Japan

ABSTRACT A new species and a new subspecies of the genus *Epanerchodus* are described from limestone caves in Ehime and Ōita Prefectures in the Islands of Shikoku and Kyushu, Southwest Japan, respectively. They are *E. incilis* n. sp. and *E. etoi bungonis* n. subsp. Both the new millipedes are probably troglophilous, showing a close affinity to each other in the gonopodal features.

In the present paper, the author will describe a new species and a new subspecies of cave-dwelling millipedes of the genus *Epanerchodus*. The former was found in two limestone caves of southwestern Shikoku, and will be called *E. incilis*. The other milliped is commonly found in the caves of eastern Kyushu, and has hitherto been known under the name of 'E. etoi.' It resembles the typical form of *E. etoi* in general appearance but has rather a peculiar gonopodal features. It may be regarded as a new subspecies of the same species, and will be called *E. etoi bungonis*. Both the millipedes are probably troglophilous, since the somatic characters show a certain degree of modification adaptive to cave life and since they appear to breed in caves.

The holotypes and a part of the paratypes of the new millipedes described in this paper will be deposited in the collection of the National Science Museum, Tokyo. Other specimens will remain in the author's collection.

Epanerchodus incilis n. sp.

[Japanese name: Nomura Obiyasude]

Diagnosis. A pigmented cavernicolous species related to *E. etoi* (Miyosi, 1955, pp. 186, 188, fig. 2; Murakami, in the present paper) in the shape of gonopods, especially in having an incision on coxae and large postfemoral process, but distinguished from it by the bifurcated tibiotarsal branch and by the angular lateral keels.

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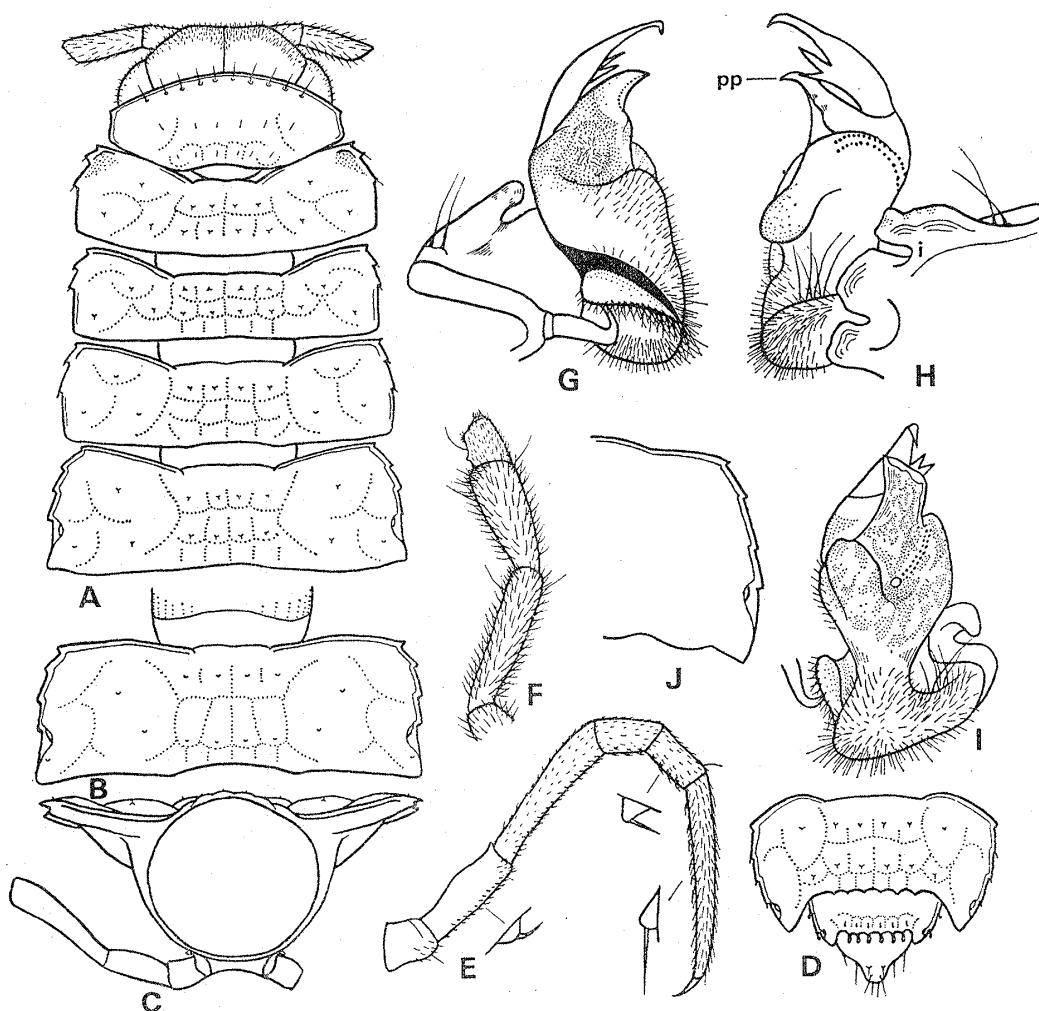


Fig. 1. *Epanerchodus incilis* n. sp., holotype (A-I) and paratype (J).—A, Head and five succeeding segments, dorsal aspect. B, Segment 10, dorsal aspect. C, The same, caudal aspect. D, Caudal end of body, dorsal aspect. E, Posterior right leg of segment 10. F, Last three articles of antennae. G-I, Left gonopod, mesial, lateral and ventral aspects. J, Outline of lateral keel on segment 12, showing a small incision on posterior margin. i=incision on gonopodal coxa, pp=postfemoral process.

Male holotype. Color pale reddish brown, antennae darker than the body. Length approximately 18 mm, greatest width 2.9 mm. Body small; slender, with relatively wide and thin lateral keels. The shape of head and of some selected segments as shown in Fig. 1 A-D; the widths of them as follows:

| | | |
|------------------|------------------|-------------------|
| Head = 1.6 mm | Collum = 1.9 mm | Seg. 2 = 2.2 mm |
| Seg. 4 = 2.4 mm | Seg. 5 = 2.6 mm | Seg. 8 = 2.9 mm |
| Seg. 15 = 2.9 mm | Seg. 16 = 2.6 mm | Seg. 18 = 1.8 mm. |

Head moderately large, oval, covered with minute hairs except for vertex. Antennae approximately 4 mm long, reaching back to the posterior border of segment 4;

articles 2–4 cylindrical; article 6 clavate; the ratio in length and in width (in parentheses) of articles 4 through 7 is 21(5):23(6):20(8):9(6); sensory hairs scattered on article 5, and moderately developed on article 6; sensory prominence on article 7 small. Collum slightly wider than head, elliptical, with rather angular outer corner; weak sculpture and three rows of bristles present on the surface; anterior and lateral sides marginate; small notch present on each side. Succeeding segments basically similar in structure to one another; dorsum slightly convex and with sculpture usual for a member of the genus. Lateral keels well developed, relatively thin, slightly reflexed, and wider than long in most of the segments (ratio of $W:L=26:20$ in segment 10). Anterior and lateral margins moderately convex, entirely bordered, and with 3–4 small notches. Posterior corners nearly rectangular in segments 2–14, becoming slightly produced from segment 15, and more acutely produced caudad. Keels of segment 19 narrow, and the tooth very small. Scapular area and posterior margins smooth. Pores open on strongly depressed lateral margin near the fourth notch of pore-bearing keels. Sternites quadrate, pubescent, and with relatively deep transverse furrow; posterior corners not produced; sternal furrow on segments 4–6 very deep. Legs slender with small spherical bristles on each podomere; claw slender and acute.

Gonopods almost fully exposed, small (about 0.7 mm in longitudinal length excluding coxa), of the form as illustrated in Fig. 1 G–I. Telopodite, *in situ*, lying parallel to median body axis. Coxa large, with a conspicuous incision (i) on the distal margin near the corner. Prefemur normal and usually beset with long fine setae. Femur large, clivus roundly swollen. Femoral cavity not so deep, seminal canal open to the innermost cavity. Postfemoral process very large, the terminal edge weakly serrate; basal portion of the process moderately concave at the inner side. Outer horn absent. Tibiotarsus slender with bifurcated branch; the shaft attenuated at the distal half and uncinate at the end.

Female paratype. Length approximately 22 mm. Posterior margin of lateral keels with a small incision on segments 9–16.

Type-series. 3♂♂ (including holotype), 6♀♀, 2 larvae, Shiinokidaba-no-taté-ana Pit, Shiinokidaba, Nomura-chō, Higashiuwa-gun, Ehime Pref., 29 April 1972, coll. by Y. Murakami; 1♀, the same pit, 7 June 1971, coll. by S. Uéno.

Other record. 1♂, 2♀♀, 1 larva, Kurosegawa-dō Cave, Hirota, Shimo-oriyai, Shirokawa-chō, Higashiuwa-gun, Ehime Pref., 8 September 1971, coll. by S. Uéno.

Notes. As was noticed before, this new species is closely related to *E. etoi*, mainly in the presence of a large postfemoral process and of an incision on the coxa of gonopods. Its type-locality, Shiinokidaba-no-taté-ana Pit, lies at about 2 km west-southwest of the town of Nomura. The other known locality, Kurosegawa-dō Cave is about 11 km distant to the east from the type pit. The milliped was usually found on the damp floor, around organic matters or on the walls in the innermost rooms.

Epanerchodus etoi bungonis n. subsp.

[Japanese name: Bungo Obiyasude]

Diagnosis. Discriminated from the nominate subspecies (Miyosi, 1955, pp. 186, 188, fig. 2) chiefly by the difference in the shape of male gonopods: slenderer tibiotarsus and larger postfemoral process.

Male holotype. Color reddish brown. Length approximately 26 mm, greatest width 3.2 mm. Body slender and nearly of the same width from segment 9 to 16. The shape of head and of some selected segments as shown in Fig. 2 A-C; the width values of them as follows:

Head = 2.2 mm

Seg. 3 = 2.7 mm

Seg. 6 = 3.2 mm

Collum = 2.2 mm

Seg. 4 = 2.8 mm

Seg. 17 = 2.5 mm

Seg. 2 = 2.7 mm

Seg. 5 = 3.0 mm

Seg. 18 = 1.9 mm.

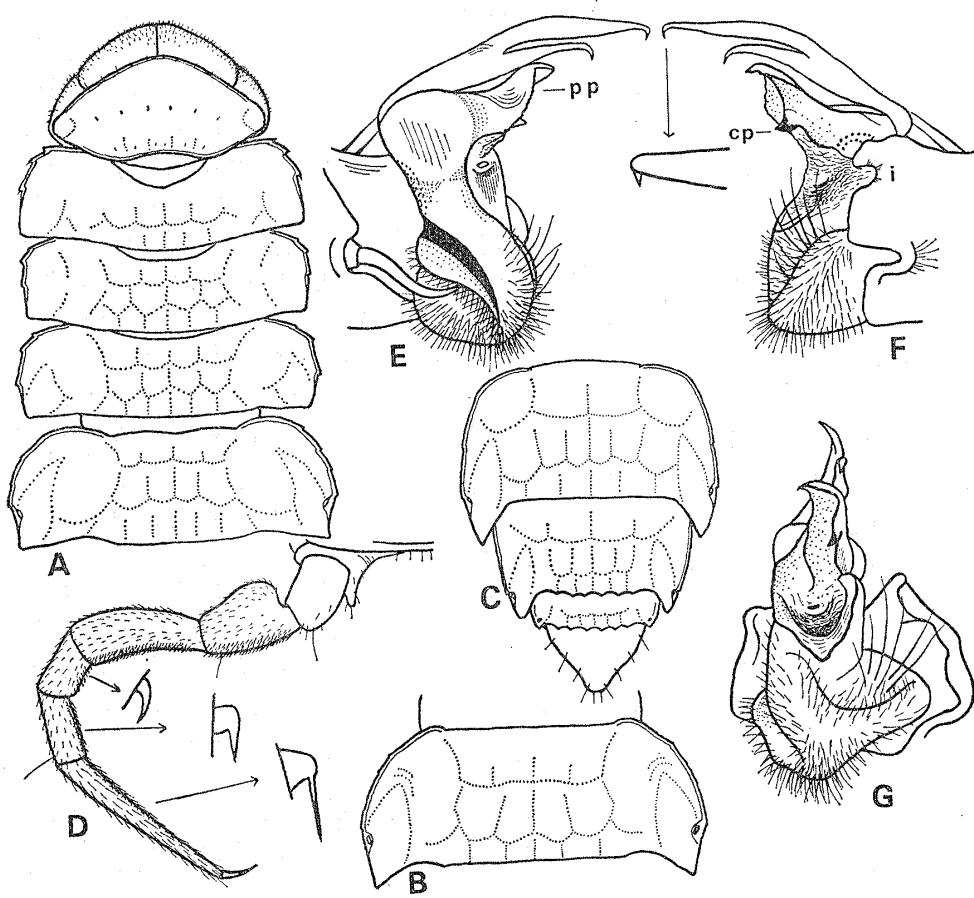


Fig. 2. *Epanerchodus etoi bungonis* n. subsp., holotype.—A, Head and five succeeding segments, dorsal aspect. B, Segment 10, dorsal aspect. C, Caudal end of body, dorsal aspect. D, Left leg on segment 7. E-G, Left gonopod, mesial, lateral and ventral aspects. cp = small chitinous process on postfemoral process, i = incision on gonopodal coxa, pp = postfemoral process.

Antennae slender, approximately 5 mm long; the ratio in length and in width (in parentheses) of articles 5 through 7 being 23(8):22(10):9(6); sensory prominence on article 7 rather small. Collum elongate-elliptical, as wide as head, its lateral sides symmetrically narrowed and slightly raised; anterior and posterior margins bordered with very fine ridge. Sternites quadrate, all not produced on posterior corners. Legs relatively long and slender. Length order of podomeres: $6>3>2>4=5>1$. Other somatic characters are the same as those in the nominate subspecies.

Gonopods of moderate size, and of the form shown in Fig. 2 E-G; telopodites, *in situ*, exposed and parallel to each other. Coxae large, cylindrical and with a large incision (i) on the distal margin near the anterior corner of outer side. Femoral region broadly constricted at the middle, the distal half somewhat flattened at the inner side, continuing to the slope of postfemoral process. Postfemoral process very massive with a small and chitinous process (cp). Tibiotarsus, *in situ*, projecting ventrad, very slender, though slightly swollen at the middle, and the tip acutely uncinated; tibiotarsal branch very slender, distally curved. Clivus inconspicuous in shape.

Female paratype. Length approximately 29 mm. Similar in appearance to the male holotype.

Type-series. 3♂♂ (including holotype), 1♀, 14 larvae, Karyū-dō Cave, Nishikami-ura, Saeki City, Ōita Pref., 27 March 1969, coll. by Y. Murakami.

Other records. 2♂♂, 2♀♀, 4 larvae, Karyū-dō Cave, 23 March 1955, coll. by S. Uéno; 6♂♂, 7♀♀, 24 larvae, the same cave, 3 March 1970, coll. by Y. Murakami. 2♂♂, 3♀♀, Onagara-dō Cave, Nakano, Honjō-mura, Ōita Pref., 28 March 1957, coll. by S. Uéno; 1♂, 1♀, 1 larva, the same cave, 8 August 1967, coll. by Y. Murakami; 2 larvae, the same cave, 30 July 1971, coll. by S. Uéno. 1♂, Furen-dō Cave, Tomari, Kawanobori, Nozu-machi, Ōita Pref., 25 March 1955, coll. by S. Uéno. 2♀♀, Iwaya-no-ana Cave, Nozu-machi, Ōita Pref., 29 July 1971, coll. by S. Uéno.

Notes. In 1955, Miyosi described a cavernicolous milliped from Akiyoshi-dō, Cave, western Honshu, under the name of *Epanerchodus etoi*. This species has since been recorded by him (1959) from many other caves in the Akiyoshi limestone area and also from several caves in Ōita Prefecture of the Island of Kyushu. Specimens from those two areas are very similar in the shape of body segments and gonopods, but the differences listed below are constantly observed between them. The author is convinced at present that these differences are sufficient to divide *E. etoi* into two geographical races.

The examples of *E. e. etoi* used for comparison were collected by Dr. Tadashi Kuramoto in the limestone cave called "Okubo-no-ana" at the Akiyoshi-dai Karst, Yamaguchi Prefecture, on October 20, 1969.

| | <i>E. e. etoi</i> | <i>E. e. bungonis</i> |
|--------------------------------|---|--|
| Gonopodal clivus | roundly produced | not developed |
| Gonopodal tibiotarsus | triangularly swollen at the upper side of the middle | slender |
| | terminal portion straight and slender, with small peculiar process near the end | acutely uncinated |
| Postfemoral process of gonopod | large, without chitinous process | more massive, with a chitinous process |
| Body length of adult specimens | 30 mm or more | 30 mm or less |

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